VIEWPOINT

DEFINING WHAT VEHICLE AUTOMATION REALLY MEANS

AUTO BEAT DAILY

Carmakers are rushing to provide their vehicles with increasing ability to pilot themselves. But the race can create confusion among about just what "autonomous driving" really means—and not just among consumers. The same concern can hamper the efficiency of the industry's efforts to innovate in this critical evolution in personal transportation. To clarify the terminology, SAE International has developed precise definitions for six levels of driving automation ranging from zero (100% human control) to five (0% human control).

Barbara Wendling

Barbara Wendling, a principal engineer with Mercedes-Benz Research & Development North America, chairs SAE's On-Road Automated Driving (ORAD) definitions task force that created the definitions. She explains how the terminology, known formally as SAE J3016, has emerged as a key definition for levels of driving automation.

Why is defining the levels of driving automation so important?

When SAE formed its ORAD committee in 2011, it was immediately obvious that developing and implementing systems that provide driving automation would be significantly encumbered unless technologists, legislators, regulators and policymakers were using the same set of definitions. That led to the formation of the definitions task force.

How did the task force proceed?

We could see right away that the general phrases being used to describe automated driving features were vague, misleading or inaccurate. This is why we prefer the phrase "driving automation" to describe the subject.

In robotic terms, for example, "autonomous" means a self-sufficient system that doesn't use external sources of information to function. In legal terms, autonomous means a system that defines its own rules of operation. Neither describes what we want future cars to be. We need them to monitor the world around them, know exactly where they are and obey the rules of the road.

"Robotic" is vague, because any type of driving automation is by definition robotic. The terms "self-driving" and "driverless" aren't clear either. They could describe vehicles with no driver on board, vehicles with drivers who aren't actually controlling the vehicle at the moment or vehicles that perform some but not necessarily all driving functions under some but perhaps not all conditions.

How are the six levels of J3016 structured?

The first three levels, zero through two, describe vehicles with little or no ability to assist in the driving process. A level zero car is one with no such aids. A level 1 system provides some driver assistance in the form of being able to steer or brake/accelerate (but not both) for extended periods. Level 1 systems expect the driver to continue to perform all other dynamic driving tasks (DDT) and be able to take over steering and braking when needed.

A level 2 system provides simultaneous steering, braking and accelerating. But the operator remains responsible for monitoring the driving environment and stepping in to resume control when conditions require it.

What about levels 3-5?

These are levels in which the driving automation system can perform DDT. A level 3 system can handle all driving tasks within a specific set of conditions—on a highway with clearly marked lanes or only below a certain speed limit, for example. With a level 4 system, there is no expectation that the driver will be called upon to intervene. If the system becomes confused or compromised, it is able to shift into a default safe operating condition. A level 5 system has the unconditional ability to cope with all DDT that a human driver could handle and with no expectation of human intervention under any circumstance.

What level describes the industry today?

The most advanced systems for sale currently are at level 2 as defined by J3016. There are no true level 3 systems available today, so we have much to do before we'll have vehicles that can go virtually anywhere with no human intervention.

What is the task force's next goal?

SAE J3016 definitions have been adopted by the U.S. National Highway Traffic Safety Administration and the United Nations. Now we're working with ISO, the International Organization for Standardization, to refine the definitions to accommodate the viewpoints of Asian and European markets. There's also the matter of applying J3016 definitions to specific vehicle features. A self-parking system that allows you to exit the vehicle and command the car to park itself might be considered a level 4 capability. But that doesn't mean you could send the car out onto the highway on its own.

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Where can readers obtain more information?

Recognizing the international importance of this standard, SAE will offer J3016 license-free to enable wide adoption by global, regional and local legislatures to expedite deployment of self-driving technologies. To download a copy, visit standards.sae.org/j3016_201609. You can also continuously learn about the latest challenges and solutions concerning connected, green, and safe technologies—and download a free infographic entitled "Automotive Standards for Connected Transportation"—at alwaysinmotion.sae.org.